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(54) EXTRUSION METHOD FOR POLY VINYL CHLORIDE GIVING BAMBOO APPEARANCE

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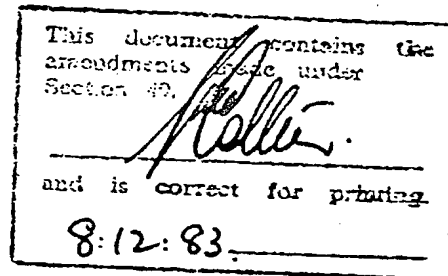
(57) Claim 1. A method for extruding a rigid polyvinyl chloride member having the appearance of natural bamboo, which method comprises extrusion under conditions of low shear of a dry blended rigid polyvinyl chloride formulation, said formulation including:-

an impact modifier comprised of a methacrylate butadiene styrene terpolymer;

between 3 and 4 parts of an acrylic processing aid per hundred parts by weight of polyvinyl chloride resin, and

between 0.05% and 0.15% by weight of the total extrudate composition of a pigment masterbatch having a low density polyethylene resin carrier and a pigment content of between 40% and 60% by weight of said carrier.

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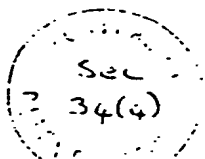
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PETTY PATENT SPECIFICATION FOR THE INVENTION ENTITLED:

"EXTRUDED PLASTICS PRODUCTS HAVING A BAMBOO-LIKE APPEARANCE"

The following statement is a full description of the invention  
including the best method of performing it known to us:



This invention is concerned with the manufacture of extruded polyvinyl chloride plastics or like products having a decorative appearance simulating that of bamboo.

Of recent times there has been a marked growth in the popularity of furniture, particularly outdoor furniture, constructed of bamboo or synthetic materials having the appearance of bamboo.

Quality furniture constructed of natural bamboo is invariably very expensive due to the high labour content involved. Timber or metal furniture painted or otherwise finished to give the appearance of bamboo generally has a very unconvincing appearance and in most cases such furniture becomes very shabby due to scratching or chipping of the surface finish.

Furniture constructed of polyvinyl chloride or like plastics materials such as tubular plastics extrusions has become widely accepted due to its relatively low cost, light weight and durability, particularly in outdoor applications. Great difficulties however have been encountered in providing plastics materials with a realistic finish to simulate natural bamboo. In most cases a bamboo-like appearance has been attained by applying one or two coats of a pigmented layer in such a manner as to obtain longitudinal streaks. In some cases a further clear lacquer is applied over the streaked layer (s) to provide at least some physical protection to preserve the appearance.

It has been found in practice however that such "painted" finishes suffer scratching and chipping which rapidly degrades the appearance of the furniture item. Further, such "painted" finishes have a poor durability when exposed to outdoor weathering conditions.

In the manufacture of extruded tubular members from polyvinyl chloride or like plastics materials for furniture, a streaked effect may be obtained by deliberately achieving a poor mixing of pigment in the plastics material during

extrusion. This may be achieved for example by using an incorrect extrusion temperature profile in the extruder, a reduced extrusion barrel pressure etc. Although pigment streaking is easily obtained in this manner, the resultant extrudate is usually of poor quality due to insufficient fluxing and mixing during extrusion. Poorly compounded polyvinyl chloride plastics materials have inferior physical properties and substantially reduced durability particularly in outdoor weathering conditions.

Other unsuccessful attempts to obtain a streaked extrudate having the appearance of natural bamboo have included the use of pigment masterbatches incorporated in a polyvinyl chloride composition having a substantially higher K value than that of the extrudate formulation. This invariably leads to the formation of surface defects in the extrudate such as "pimples" of masterbatch and longitudinal scoring of the extrudate surface.

Such blemishes are unsightly and unacceptable in the manufacture of a high quality furniture product.

In an alternative method, streaking may be obtained by the use of pigment masterbatches compounded in a resin vehicle which is substantially incompatible with the polyvinyl chloride extrudate formulation. A typical incompatible masterbatch resin may include a low density polyethylene base but when used in normal concentrations in a conventional polyvinyl chloride formulation under poor mixing or low shear conditions to obtain streaking, lamination of the extrudate may occur. Lamination due to incompatible resins will cause early breakdown of a polyvinyl chloride product under outdoor weathering conditions

It is an aim of the present invention to overcome or alleviate the problems of prior art extrusion processes aiming to produce a durable product having a bamboo-like appearance and to provide a durable plastics product with the appearance of natural bamboo.

According to the invention there is provided a method

for extruding a rigid polyvinyl chloride member having the appearance of natural bamboo, which method comprises extrusion under conditions of low shear of a dry blended rigid polyvinyl chloride formulation, said formulation including:-

an impact modifier comprised of a methacrylate butadiene styrene terpolymer;

between 3 and 4 parts of an acrylic processing aid per hundred parts by weight of polyvinyl chloride resin, and

between 0.05% and 0.15% by weight of the total extrudate composition of a pigment masterbatch having a low density polyethylene resin carrier and a pigment content of between 40% and 60% by weight of said carrier.

A preferred embodiment of the invention will now be described with reference to the following example.

A feed material having the following formulation was dry blended in a high speed mixer under conventional blending conditions:-



	Raw Material		Parts per 100 Polymer
	Generic Name	Trade Name Supplier	
5	P.V.C. Polymer	Geon 105 (TM)	Goodrich 100.0
	Impact Modifier	Kureha BTA 111 N (TM)	Kureha 10.8
10	Stabiliser	Tribasic Lead Sulphate (TBLS)	Ferro Corp. 4.8
	Processing Aid	Paraloid K120N (TM)	Rohm & Haas 3.4
	Stabiliser/ Lubricant	Calcium Stearate	Ferro Corp. 0.8
15	Lubricant	Advowax 280 (TM)	Cinnccinnati Millicon Chemicals 0.3
	Lubricant	Ferrolube H (TM)	Ferro Corp. 0.2
20	Stabiliser/ Lubricant	n. Lead Stearate	Ferro Corp. 0.7
	Filler	Omyacarb 2T (TM)	Omya Minerals 8.6
	Processing Lubricant	Disooctyl Phthalate (DIOP)	C.S.R. 1.0
25	U.V. Absorber	Tinuvin P (TM)	Ciba Geigy 0.2
		<u>TOTAL</u>	130.8

Towards the end of the blending cycle a pigment master batch  
 comprised of low density polyethylene containing 50%  
 pigment was added to the dry blend at a rate of 0.1% by weight.



The dry blend material was then fed into the hopper of a single screw extruder having a deep flighted low shear profile screw. The L:D (length:diameter) ratio was 26:1 and the shear ratio was of the order of 0.07 - 0.08mm flight depth per millimetre of screw diameter at the metered end of the screw.

The temperature profile of the extruder was set as follows:-

Barrel Zone (°C)				Head/Die Zones (°C)			
1	2	3	4	1	2	3	4
100 $\pm$ 5	150 $\pm$ 5	195 $\pm$ 5	195 $\pm$ 5	195 $\pm$ 5	195 $\pm$ 5	195 $\pm$ 5	195 $\pm$ 5

Hopper  $\longrightarrow$  Die

By adjusting screw speed to obtain a satisfactory extrusion rate for the die profile, the extrudate issues with a high quality surface finish and pronounced pigment streaks having the appearance of natural bamboo. The relatively low temperatures at the feed end of the extruder allow the dry blend to progress to the central region of the screw before gelation of the polyvinyl chloride resin commences. By retarding gelation of the polyvinyl chloride resin, the tendency to dispersion of the masterbatch is substantially reduced.

It has been found that the surprisingly realistic appearance of natural bamboo is dependent upon the combination of the low shear extrusion conditions and certain of the formulation ingredients.

The most suitable impact modifier has been found to be a methacrylate butadiene styrene terpolymer. Impact modifiers such as acrylonitrile butadiene styrene, ethacrylate butadiene styrene and other modified butadiene styrene copolymers and terpolymers commonly used in rigid polyvinyl chloride polymers have been found to be significantly less successful in the present invention. Although it is

considered that other types of impact modifiers could be found successful in the practice of the invention, great care is needed in the use of impact modifiers to prevent substantially complete dispersion of masterbatched pigment because of earlier gelation and/or reduction in melt viscosity of the feed material within the extruder barrel.

Possibly the most surprising contribution to the working of the invention is the incorporation of a conventional acrylic processing aid at a concentration in excess of twice that normally used in rigid polyvinyl chloride extrusions.

Conventional acrylic processing aids are normally incorporated into rigid polyvinyl chloride formulations at between 0.5 and 1.5 parts per hundred of P.V.C. resin. Great care is usually taken not to exceed optimum concentrations due to the high cost of such materials and also because in excess of such concentrations under normal extrusion conditions, no additional benefits are obtained in extrusion rates. A further reason for avoiding excess addition of acrylic processing aids is that the impact strength of rigid polyvinyl chloride extrudates may be substantially reduced by these materials.

The abnormally high concentration (more than twice that of a comparable rigid P.V.C. extrusion produced under normal extrusion conditions) of the processing aid gives rise to a rapid fluxing of the feed material at the metering end of the extruder barrel. This delayed rapid fluxing is required to fully compound or homogenize the dry blend formulation in the absence of the normally present high shear conditions otherwise required to compound rigid P.V.C. dry blend formulations. The avoidance of high shear conditions prevents excessive dispersion of the masterbatched pigment within the metering zone of the extruder barrel.

By maintaining the concentration of pigment masterbatch at a very low level in the dry blend formulation, more pronounced pigment "streaks" or striations are obtained.



Concentrations of pigment masterbatch at the normally expected higher levels result in a more uniform colour dispersion in the extrudate when employed with the polyvinyl chloride formulation and low shear extrusion conditions according to the invention.

The product produced by the process of the invention has been found to have excellent physical properties, including that of impact strength, as well as excellent resistance to outdoor weathering. As the streaked pigmentation occurs right through the body of the extrudate, the aesthetic qualities of furniture manufactured with such extrudates are retained despite normal wear and tear which might otherwise impair the appearance of painted or lacquered surfaces.

It will be readily apparent to a skilled addressee that many modifications or variations may be made to the present invention without departing from the spirit and scope thereof.

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THE CLAIM DEFINING THE INVENTION IS AS FOLLOWS:-

1. A method for extruding a rigid polyvinyl chloride member having the appearance of natural bamboo, which method comprises extrusion under conditions of low shear of a dry blended rigid polyvinyl chloride formulation, said formulation including:-

an impact modifier comprised of a methacrylate butadiene styrene terpolymer;

between 3 and 4 parts of an acrylic processing aid per hundred parts by weight of polyvinyl chloride resin, and

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DATED THIS TWELFTH DAY OF AUGUST, 1983.

MEYERS TAYLOR SALES PTY. LTD.

By its Patent Attorneys,

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